

A BOTANICAL SURVEY OF *CANNABIS* IN THE HIMALAYAS¹

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The Himalayas are known for their wild or nearly wild populations of *Cannabis*. These mountain ranges also have a folklore for *Cannabis*. Botanical studies of *Cannabis* populations in their natural habitats in the Himalayas are of great significance for understanding the ecological, biochemical, and genetic relationships existing in the taxon. It is suggested that a concerted, thorough investigation of this mysterious plant be made in its probable home in the Himalayas. The findings of a preliminary survey of *Cannabis* in the Himalayas are discussed.

The purpose of this paper is to report some botanical characteristics and phenotypic variations in *Cannabis* as observed in a wide variety of microhabitats and macrohabitats in the northern Himalayas.

The Himalayas are an excellent laboratory for the study of *Cannabis*. This enigmatic taxon occurs in the 2,500 kilometre long Himalayan arc stretching from Afghanistan to Burma and covering the northern highlands of Afghanistan, Pakistan, India, Tibet, Nepal, Bhutan, and Burma. *Cannabis* is considered native to central Asia. The northern Himalayas have wild or nearly wild populations, mostly untouched by man. These mountains have large areas of sparse human habitation, permitting the discovery of pockets of wild populations in the area. In addition, some of the ancient scriptures of India mention the medical, religious, and social significance of *Cannabis* in the area as far back as 5,000 B.C. The sacred *Vedas* and *Susruta* are scriptures known for their descriptions of this plant, one of man's oldest companions in the northern

Himalayas.

Cannabis is five-purpose economic plant: the source of fiber, food, medicine, oil, and narcotic. Accordingly, it is commonly cultivated in the Himalayas. It is an extremely misunderstood plant, especially in the western countries of the world. There is no agreement concerning its family assignment. There is controversy about its taxonomy. It has been maintained by some (Small 1974; Small and Cronquist 1976) that there is only one species, *Cannabis sativa*; while others (Emboden 1974; Schultes *et al.* 1974) believe it to be polytypic. Ecologically, it presents several baffling problems. Its plasticity is not completely understood. The factors controlling its weedy aggressiveness and its narcotic potency are still argued by many. These biological enigmas have social and legal implications, especially in Western countries where it is widely used or misused as an inebriant.

Strangely there is dearth of biological data on *Cannabis* in its natural habitat in the northern Himalayas. Preliminary information on altitudinal variation and embryology is, however, available (Ram and Nath 1964; Sharma 1975). I travelled extensively in the northern Himalayas in 1970, 1973, and 1976 making

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field observations and collecting data on *Cannabis* from a wide variety of habitats and elevations in areas conspicuous for their populations of *Cannabis*. Most of the observations were made in the provinces of Himachal Pradesh, Punjab, and Jammu & Kashmir in northern India. These areas of northern India are contiguous to the wild, uninhabited borders of Tibet and Pakistan. Gross morphological variations in populations and general features of their habitat were recorded in the field.

During laboratory studies on *Cannabis* of different geographic origins from different countries of the world, there is a tendency to label the habitat of these populations corresponding to the general climatic conditions of that country without any real consideration of the fact that local microhabitat parameters are extremely crucial to the growth and phenotype of *Cannabis*. It is, moreover, doubtful if the laboratory or controlled studies without the basic supplemental data from the native range and habitat of *Cannabis* can aid in clarifying many of the botanical, ecological, and biochemical problems. Our knowledge gap is often the direct result of lack of study of *Cannabis* in its natural habitat. Thus, different microhabitats representing extremely diverse conditions within a country can lead to extensive plasticity and variability in *Cannabis*. This phenomenon is true especially in the Himalayas, where *Cannabis* exhibits especially high plasticity. Unless it be studied in depth in its probable home—the Himalayas, it is doubtful whether we can resolve many of our uncertainties about the plant.

It is not unusual to find two different populations of *Cannabis* exhibiting entirely different morphological features on the same slope. It owes this remarkable plasticity to ecological factors in the microhabitat. It is erroneous,

for example, to say that *Cannabis* from a certain slope represents a certain population, since I have seen the difference of a single factor producing variation in plant populations on the same slope.

In the areas surveyed between 250 and 3,050 metres, I found distinct variation in the gross morphology of *Cannabis* populations. Plant habit, size, leaf size and colour, foliar characteristics (colour, growth, and odour) and seed size were found to be plastic—a plasticity depending upon habitat, elevation, and soil factors. Plants growing on man-made, nutrient-rich soils grew to a height of more than four metres with dark green, strong-smelling foliage—and this regardless of elevation. These plant populations produced large leaves, thick stems, and extensive roots. Furthermore, these plants cannot be called truly wild: they were either grown by man or indirectly nourished by man. *Cannabis* growing in the same general area but not on refuse or man-altered, nutrient-rich soil exhibited growth typical of the ecological region.

Under wild conditions, however, *Cannabis* at higher elevations was larger, laxly branched, vigorous, and had larger leaves than at lower elevations. They also had a strong odour and bright green foliage.

Cannabis is a heliophile: quite evident in its probable native home in the higher elevations in the Himalayas. Of all the populations surveyed in these mountains, I found not even a single population growing in the shade. In the plains area or at low elevations, where summer temperatures were extremely high (40°C), *Cannabis* grew both in shade and in direct sunlight.

At higher elevations, nearly all the *Cannabis* grew on south-facing slopes exclusively while the north-facing slopes—cooler and moister—were devoid of *Cannabis*. At lower eleva-

tions, however, both the north-facing and south-facing slopes had populations, because of the favourable temperatures, an important feature affecting the botany and ecology of the plant during its entire life cycle. I found no *Cannabis* populations above 3,050 metres in the northern Himalayas.

In all cases, pistillate *Cannabis* was found to be more branched and bushy than the weaker-looking staminate individuals. This distinction was one of the best ways to separate male from female prior to flowering. Further, pistillate plants were generally bright green, while staminate individuals were greyish green. The "bark" of the older females was somewhat thicker than that of the males. A close look at the lower section of the stems of female plants showed distinct, horizontal ridges, whereas the male stems had dots or tiny spot-like structures, less conspicuous than the ridges of the female. This pattern I observed consistently in all habitats at all elevations.

Cannabis is usually the dominant plant in an herbaceous plant community—thus supporting the suggestion that its aggressiveness or dominance may be due to allelopathic properties. Very few weeds were able to grow among or compete with *Cannabis*, especially at lower elevations, where pure colonies of the plant were abundant. In cultivated fields, therefore, *Cannabis* is considered to be a menace to other crops and is weeded out as early as possible.

Generally, at high elevations, the seeds from the preceding autumn germinate about the end of March. Blooming occurs in early June, and the enormous amount of pollen produced by male plants becomes extremely conspicuous in the atmosphere. In the plains at lower elevations, pollen production occurs even earlier in the growing season, since the seeds produced in early autumn germinate in December or

January, leading to earlier blooming. At high elevations, *Cannabis* produces seeds in late summer, while ripening takes place in November, the plant then dies. Cold winters at high elevations provide a dormant period; hence germination of seeds produced in the preceding season does not take place until March of the following year.

While it is known that *Cannabis* has had a long association with man, there are many disturbed habitats in the area where *Cannabis* has carried on well for years without any direct interference by man. Abandoned terraces, old farm sites, roadsides, and railroads are some of the sites where *Cannabis* colonized as a dominant species. Cultivated fields are also invaded by *Cannabis*, although it is weeded out early in the growing season simply for survival of the cultivated crops. When it competes and survives in both wild and man-made habitats it exhibits its gregariousness—itsself an enigmatic phenomenon, requiring detailed investigations.

A general count of male and female plants at low and high elevations indicated a gradual preponderance of female individuals over the male with increase in elevation. It might be interpreted as ensuring fertilization, seed production, and hence survival and continuity of the species in the relatively harsh environment and short growing season of higher elevations. The reverse was evident in the plains and at lower elevations, where male individuals outnumbered female plants. In all cases, male plants withered away earlier in the season than the female *Cannabis* plants.

Field observations in the Himalayas indicate clearly that sandy soils are decidedly poor for growth of *Cannabis*, whether in the plains, low elevations or at high altitudes. The plants growing in sandy soils were dwarfed or even prostrate in some cases with thin stems, small

leaves, small seeds, and gave the general appearance of stunted growth. Soils rich in organic matter, however, are the best for its growth. This observation in wild populations in the Himalayas supports the well recognized fact that *Cannabis* is a "heavy feeder."

Plants in the plains area were usually smaller than plants under similar habitats at higher elevations. Seeds produced by populations at high elevations were larger than those at low elevations. But, the plants of lower elevations produced seeds in greater abundance—perhaps a significant evolutionary characteristic. It seems, therefore, safe to suggest that in the northern Himalayan region, seed size in *Cannabis* is proportional to plant size and to overall vigour of growth. Furthermore, I found a slight colour difference in seeds of different populations. Seeds of mountain populations tended to be somewhat light grey, while the colour in the plains was distinctly dark grey.

I must make special mention of several populations growing in valleys (elevation 2,500 metres+) surrounded by ice and snow-covered mountains in the background rising to a height of 7,000 metres. Cool, dry, crisp mountain breezes were typical of these areas. Sunny, clear, bright days characterized the early autumn, and the nights were bitterly cold.

These are areas renowned for extremely potent *Cannabis*. The plants collected from these areas had a very rank-smelling, dark green foliage, excellent growth, and large seeds—suggestive that these characteristics might possibly be correlated with the narcotic strength of the plants.

Finally, it seems obvious that *Cannabis* shows great phenotypic plasticity and perhaps corresponding variation in narcotic potency in different habitats in the northern Himalayas, although the latter speculation requires long and critical biochemical analysis. Intensive and extensive botanizing in the Himalayas will undoubtedly produce answers to many of the questions posed by this bewildering plant. The legal, bureaucratic, and social implications at present certainly hinder free flow of information and understanding of *Cannabis* in its natural habitat in the Himalayas. *Cannabis* research does not have the same glamour in the East as it does in western countries for very obvious reasons. It is doubtful, therefore, that scientific skills and/or resources of the East can be expected to be applied to a thorough botanical and ecological investigation. As a result, a major hurdle to understanding this important plant in its natural habitat in central Asia needs to be cleared.

REFERENCES

- EMBODEN, W. A. (1974): *Cannabis*—a polytypic genus. *Economic Botany* 28: 304-310.
- RAM, H. Y. MOHAN AND NATH, R. (1964): The morphology and embryology of *Cannabis sativa* L. *Phytomorphology* 14: 414-429.
- SCHULTES, R., KLEIN, W., PLOWMAN, T., AND LOCKWOOD, T. (1974): *Cannabis*: an example of taxonomic neglect. *Harvard Univ. Bot. Mus. Leaflet* 23: 337-367.
- SHARMA, G. K. (1975): Altitudinal variation in leaf epidermal patterns of *Cannabis sativa*. *Bull. Torrey Botanical Club* 102: 199-200.
- SMALL, E. (1975): On toadstool soup and legal species of marihuana. *Plant Science Bulletin* 21: 35-39.
- SMALL, E. AND CRONQUIST, A. (1976): A practical and natural taxonomy for *Cannabis*. *Taxon* 25: 405-435.